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ABSTRACT

The Educational Computer User's Network at Battelle Columbus Laboratories is a cooperative computer center effort between a group of Ohio colleges, secondary schools, and a large research-oriented organization. This description of the program includes the historical background, program concept, data processing development, hardware and software, costs, and future plans. Program advantages are identified as cooperation among the participants, minimal costs, services rendered to the colleges, staff support, and student learning; problem areas include communications between cooperating units, uncontrolled usage, and academic/administrative imbalance. (CMV)

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BECUN

The Educational Computer User's Network at Battelle

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BECUN
THE EDUCATIONAL COMPUTER USER'S NETWORK AT BATTELLE

BATTELLE
Columbus Laboratories

The Educational Computer User's Network at Battelle represents a unique application of the joint-computer-center concept. The program is unique in two respects. First, it is a cooperative effort between a group of Ohio colleges, secondary schools, and a large research-oriented organization. Second, the entire program has proceeded without any federal or other outside financial support. Both Battelle and the schools have participated by utilizing funds available within their own operating budgets.

The purpose of this paper is to describe the program and some of its results from the viewpoint of Battelle's Computer Center.

HISTORICAL BACKGROUND

The Columbus Laboratories of Battelle comprise the original research center of a public-purpose, multinational organization devoted to scientific research and development. Battelle's broad objective is the advancement and utilization of science for the benefit of mankind through the processes of technological innovation, and the better education of man. It was founded in 1929 in Columbus, Ohio, by the will of Mr. Gordon Battelle, an Ohio iron and steel industrialist.

Battelle-Columbus acquired its first digital computer--an IBM 650--in 1956. For several years this computer was used primarily in connection with one large research project. However, beginning in 1960, two much broader objectives were established for the Computer Center. The first objective was to encourage and support data processing throughout the Battelle-Columbus Laboratories. The second objective called for the Battelle Computer Center to become a leader in data processing research. To help achieve these objectives, an active program was undertaken to encourage other operating divisions within Battelle-Columbus to learn how to use computers in their fields of technology. In addition, the IBM 650 was replaced with a more modern, state-of-the-art computer, and people with broad industrial and military experience in data processing were brought to Battelle.

During the next five or six years, computer technology advanced rapidly. By 1966 the Computer Center was already considering a replacement for its third computer system. Computer science graduates were beginning to appear for the first time and people with strong technical backgrounds in data processing were much easier to find. Unfortunately, however, graduates of small liberal arts colleges with exposure to data processing were almost

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impossible to locate. The reason was that most such colleges had simply not been able to keep pace with this new field of technology. Not only had their graduates usually no significant exposure to computer technology, but in many cases even the basic terminology of computing was unknown to them.

At about this time, a group of seven Ohio colleges recognized the problem and decided to do something about it. They banded together in the hopes of finding a mutual solution to their common problem. As a first step, the group jointly sponsored a systems study to determine the extent to which data processing capabilities were needed by the colleges and to identify means of acquiring these capabilities. This study, conducted for the colleges by an outside organization, recommended that the colleges undertake a cooperative program in computing and listed three possible sources for a centralized computer facility: (1) a new computer center jointly established and supported by the seven colleges, (2) The Ohio State University; and (3) Battelle's Columbus Laboratories. After considering the recommendations of the report and other factors, the seven colleges decided to approach Battelle for the purpose of developing a joint proposal to the National Science Foundation for financial aid.

An NSF proposal was subsequently developed by the seven colleges and Battelle-Columbus. The proposal called for a three-year program. Under the program, the existing Battelle-Columbus Computer Center would serve as the central facility and provide the focal point needed to mount a cooperative effort in data processing. Each college would have access to the Computer Center facility via a remote batch terminal. In addition, the proposal covered such areas as staff acquisition, staff training, curriculum development, and evaluation of progress under the program. The area of administrative data processing, however, was considered to be outside the scope of the proposal.

After many review cycles, this proposal was put into final form and submitted to the colleges for signatures. Unfortunately, one of the seven schools had, in the meantime, decided to go its own way in computing and declined to approve the proposal.

At this point, more than a year's effort seemed in danger of being lost. However, Dr. Hans Jenny of The College of Wooster came to the rescue. Dr. Jenny decided that Wooster must have a data processing capability, and proposed that if Battelle-Columbus were willing to go ahead with its portion of the program, The College of Wooster would participate without NSF support. This decision marked the beginning of the Battelle-Columbus College Program.

By December of 1967, The College of Wooster and Battelle-Columbus had entered into a contractual arrangement. For the next six months the use of the computer by Wooster remained sparse, as Wooster personnel had to commute back and forth to Columbus, a distance of 100 miles. However, in the summer of 1968, Wooster acquired a remote batch

terminal. Computer usage then picked up dramatically with the start of the fall term and has grown steadily ever since. Later, during the summer of 1971, multiplexing hardware was added to Wooster's communication system and with the start of the fall term in 1971 they had four interactive ports into the Battelle computer system.

As the news of Wooster's success spread, other colleges became interested. During the summer of 1969, both Otterbein College and Antioch College joined the program. (Otterbein and Antioch, like Wooster, had been members of the original seven college group.) A fourth school Ohio Dominican College, joined the program late in 1971. Capital University joined in 1972, beginning with interactive processing via TTYs, and Capital currently also is using a remote batch terminal. In 1974, Central Ohio Technical College and the University of Northern Iowa joined BECUN. As the University of Northern Iowa has its own computing capabilities, its use of Battelle's Computer Center is special purpose. Franklin University in Columbus joined the program in 1975, while Antioch College withdrew from the program.

Also, in 1972 a move was made to further strengthen the program. The Center for Improved Education and the Computer Center at Battelle combined together to organize all educational computing activities, including colleges and high schools, into one group known as BECUN. The Computer Center and the Center for Improved Education jointly offer a broad base of educational knowledge, technical expertise, and software/hardware resources to help schools and colleges satisfy their computing needs.

PROGRAM CONCEPT

Under the program, all of the resources of the Battelle-Columbus Computer Center are made available to the colleges. This means that they are provided access to the same hardware, software, and technical assistance as Battelle's own large staff. The colleges are, in effect, treated as an extension of the staff in this respect. Routine technical assistance is made available free of charge and there is an absence of discrimination in matters of usage, charges, turn around, and so on. These policies enable the colleges to feel that they are indeed "first class" users. Further, the colleges are free to use the Battelle facilities as little or as much as they wish, paying only for what they use when they use it. Membership in the program does not commit the colleges to any long-term arrangement, and they can use other sources of data processing as they see fit. Finally, cooperation among the members is actively encouraged and supported--this being made a good deal easier, of course, by the use of a common facility.

All of this is consistent with the objective of the program, which is to assist the colleges in achieving a mature posture in the use of computing for their academic, administrative, and research needs. The intention is to perpetuate the program only so long as it best serves the interests of the colleges. Thus, when the members--either independently or collectively--decide their purposes would be better served by a different course, Battelle expects to cooperate fully in whatever way is appropriate.

DEVELOPMENT UNDER THE PROGRAM

In terms of the growth pattern in data processing at the colleges, the program has typically proceeded in three phases. During the first phase, a college often uses couriers to bring work to Battelle. This may mark the college's first exposure to data processing. Ohio Dominican--located in Columbus--began their activity in this manner. Once a day a student would bring work to Battelle and wait for the output; usually his wait would be less than a half-hour. Otterbein, which is located near Columbus, made two trips a day for about one year when in this phase. Wooster's travel during this phase was on an as-needed basis.

As one would expect, the growth in computer usage is comparatively slow during this first phase. However, this phase does provide time for the colleges to develop administrative applications so that when they do acquire a terminal they will already have some existing workload.

The second phase begins with the acquisition of a remote batch terminal. Wooster has recently upgraded to a Control Data Corporation 1700 minicomputer for use as a remote batch terminal and to provide selected local processing; Otterbein and Capital all currently have Control Data Corporation 200 User Terminals; Central Ohio Technical College has a Data 100 remote batch terminal. These terminals consist of a 330 card-per-minute card reader, a 300 line-per-minute printer, plus a keyboard and cathode ray tube. The terminals are linked via telephone lines to the Battelle Computer Center. During this phase, the colleges operate the terminal as though it were a stand-alone computer. The same terminal is used for academic, administrative, and research purposes. Operational procedures resemble those seen in many other open-shop computer facilities.

During the second phase, growth is usually rapid in all areas. Additional administrative packages are developed and implemented. Students and faculty quickly discover the capability of the "computer" and put it to good use. Usually, at the conclusion of this phase the colleges have already developed a very sophisticated batch processing capability.

The third phase is very closely related to the second and begins when interactive computing capability is added. With this capability, the student, instructor, and researcher now have the choice of using either the

batch or the interactive approach for instructional usage. The administrative systems designer can utilize this capability for source data entry or for on-line data retrieval from immediately accessible data bases. The system in use at Battelle permits the user to move with complete freedom between the batch and interactive environment, choosing whichever best suits his purposes at the moment. No program conversion is required since the same software is used on both environments. Also, a data base developed in one environment is accessible from the other. At the present time, Wooster, Otterbein, and Capital have been in this phase for several years.

As can be expected, exceptions to the above pattern have occurred. These have resulted primarily from the varying, individual needs of each school and the increasing desirability of interactive computing. For example, Franklin University's first application was an on-line registration system. A CRT terminal at their school has provided access to the computer. Batch processing, initiated from the on-line terminal, is used for appropriate support. Work is currently under consideration to expand usage beyond registration and grade reporting to include Business Office functions.

HARDWARE AND SOFTWARE

Tables 1 and 2 show the hardware that is currently in use at the Computer Center.

As shown in the tables, the Computer Center operates both a CDC 6500 and a CDC CYBER 73-16. These computers are roughly equivalent in internal speed and both are in the large computer category. The 6500 has 1,310,720 characters of central memory, while the CYBER has 983,040 characters. One machine--the 6500--is devoted to interactive computing, while the other handles local and remote batch processing. The two computers are tied together by a 5.12 million characters large core memory and communicate via this means.

Two types of disk storage are available. First, both systems share ten large disk pack drives, storing more than 1.4 billion characters of data. This storage is available to both batch and interactive users for the cataloging and retention of files. This is often described as on-line storage of data. Second, the batch computer has eight large (35 million characters) disk pack drives for use as private devices. These may be used in a way similar to magnetic tapes (e.g. a school may have alumni files on a disk pack which is mounted when a batch job requests it for processing).

Telecommunications from remote users are handled by a logical front-end device. Eighty-four communication ports are available and the communication speeds vary from 110 baud to 1200 baud asynchronously, and from 2000 baud to 40.8 kilobaud synchronously. This device is connected to the interactive computer. Remote batch usage flows in and out of the interactive computer and is transferred to the batch computer for processing.

TABLE 1. BATTELLE-COLUMBUS COMPUTER CENTER
HARDWARE AS OF OCTOBER 1, 1977

Quantity	Device	Characteristics
	TIMESHARING HARDWARE	
	Computer	
1	CDC 6500	1 million instructions per second/2 central processors
12	Data Channels	
10	Peripheral Processors	
1	Central Memory Unit	1,310,720 characters
1	Logical Front End	Total of 84 ports
	Mass Storage	
1	Large Core Memory	2.56 million characters
10	Disk Pack Drives	Total of 1.4 billion characters which is also accessible from the batch machine
	BATCH HARDWARE	
	Computer	
1	CDC CYBER 73-16	1.2 million instructions per second
12	Data Channels	
10	Peripheral Processors	
1	Central Memory Unit	983,040 characters

TABLE 1. BATTELLE-COLUMBUS COMPUTER CENTER HARDWARE AS OF OCTOBER 1, 1977 (Continued)

Quantity	Device	Characteristics
	BATCH HARDWARE (Continued)	
	Mass Storage	
1	Large Core Memory	2.56 million characters
8	Disk Pack Drives	35 million characters each
8	Magnetic Tape Drives	9-track (6) and 7-track (2)
	Input/Output Equipment	
3	Card Readers	1200 cards per minute
4	Line Printers	2 of 1200 lines per minute 2 of 1000 lines per minute
1	Electromechanical Plotter	11-inch drum
1	Card Punch	250 cards per minute
	MICROFILM RECORDER	
1	Stromberg DatagraphiX 4060 Microfilm Recorder	16mm or 35mm sprocketed, 16mm unsprocketed cameras. Immediate positive film and hardcopy for 35mm output
	Includes	
1	Honeywell 516	Half-million instructions per second, real-time clock
1	Central Memory Unit	16,000 16-bit words
2	Magnetic Tape Drives	1 7-track 1 9-track

TABLE 1. BATTELLE-COLUMBUS COMPUTER CENTER HARDWARE AS OF OCTOBER 1, 1977 (Continued)

Quantity	Device	Characteristics
	MICROFILM RECORDER (Continued)	
1	Analog-to-Digital Converter	
1	Paper Tape Reader/Punch	300 characters second reading 110 characters per second punching
	CYBER GRAPHICS TERMINAL	
1	CDC CYBER 777 Graphics	24-inch refresh tube, light-pen, hardware windowing and scissoring
	Includes	
1	CDC System-17	Half-million instructions per second
1	Central Memory Unit	32,000 16-bit words
1	Communications Controller	Communicates with CDC 6500 at 40.8-50 Kilobaud
1	Card Reader	300 cards per minute
1	Line Printer	300 lines per minute

The following list represents a sample of terminals commonly in use at the Battelle Computer Center. Those terminals marked with an (*) are available for user access at the central site facility.

TABLE 2. OTHER HARDWARE (TERMINALS)

	Device
*	Tektronix 4012 Direct View Storage Tube (DVST) Graphics Terminals
*	Tektronix 4014 DVST Graphics Terminal
*	Texas Instruments Model 733 ARS (with dual magnetic tape cassettes)
*	Texas Instruments Model 733 KSR
*	Texas Instruments Model 745 (Suitcase portable)
*	Model 33 Teletypewriters
*	Anderson Jacobson 832 Terminal (wide carriage, Diablo printer)
*	Hewlett Packard 2645A (semi-intelligent CRT with cassettes)
	Sycor Intelligent Terminal
	Hazeltine 2000 CRT Terminal
*	Digilog Terminal

All of the various printers, plotters, punches, and paper tape devices located at the Center are directly available to the remote user. Output from these devices is ordinarily mailed to the colleges. The same is true for the large, high-speed off-line microfilm plotter. All of these devices have been used productively by the colleges.

As regards software, both the interactive and remote batch user can access all of the Computer Center software. The languages in general used by the colleges are BASIC, FORTRAN, COBOL, and SNOBOL, and they use a wide range of application packages as well. Both the Dartmouth and Beloit libraries have been implemented.

Much of the general-purpose software development--or conversion of packages acquired elsewhere--has been a joint effort between Battelle and one or more of the colleges. In some cases, Battelle has supplied machine time at no cost with the understanding that the resulting software would be made available to all Computer Center users.

One important function of the Battelle Computer Center is performed by the Software Support Services Group. The mission of this group is to assist users with programming problems and to provide general coordination of user activities. This type of assistance is available to the colleges at no cost.

Each of the colleges perform a similar function for their users. In general, this is done through the appointment of a "coordinator of data processing" at the college. The coordinator handles all communication between the college and Battelle. He concerns himself with policy problems, budgets, operations, library functions, and consulting. All information coming to or from Battelle passes between him and his counterpart in the Battelle Software Support Services Group. The outstanding caliber of these college coordinators has been one of the major keystones in the success of the program.

Beyond the normal day-to-day need for assistance, Battelle-Columbus has provided staff assistance to the colleges on a cost-incurred basis. Battelle personnel have, for instance, taught courses at many of the colleges. An administrative system study and design was performed for Otterbein, which later implemented the design. As another example, a joint effort between Antioch, Otterbein, Wooster, and Battelle led to the design and implementation of a sophisticated alumni history and gift accounting system. Many other smaller projects have been carried out jointly.

We at Battelle believe that the colleges participating in this program have access to as much data processing power as many of the largest universities. At first exposure to this power, each college has a natural tendency to flounder a bit, wondering where to start. However, with the advice and help of Battelle and the older members of the group, each new member has been able to move ahead quickly and to make rapid progress toward achieving maturity in data processing.

COSTS

Under the program, every job is costed and billed to the college. Therefore, the college user must decide, before making a run, whether the use of the computer is justifiable. With this approach, application programs are not developed just "because there is extra computer time and thus there is no cost". Students learn that the computer is a tool--not a toy--because their grade may depend upon their computer costs. Sloppy systems design and programming are not easily hidden. In far too many in-house computer facilities, applications are developed simply because the machine is relatively idle. Users come to depend upon these applications. Later, as the computer load grows, it becomes obvious that some of these "free" applications are not cost-justifiable, but it is then probably too late to get rid of them. As a result, these applications are reflected in increased hardware costs for expansion or a larger machine. In the present program these problems are avoided because the user is forced to consider economic justification at the start.

The members of BECUN pay the same rates as all other Battelle Computer Center users. The schools are, however, treated as a group sponsor (a group of individual concerns jointly sponsoring a single research activity). This allows the group to qualify for bulk-use rates. In fact, after an initial base-usage level is reached each month, costs are discounted up to 80 percent. This, of course, does much to encourage long-term growth in computing at the colleges.

During its first year of participation in the program, each school is guaranteed that its computer usage costs will not exceed $1500 per month. This enables colleges entering the program with little or no computing experience on other systems to experiment. It also helps colleges with experience on other systems to convert their existing applications. Further, it insures any new college that the costs of learning a new system will be tightly controlled, and permits the college to gather information to project their data processing budget for future years.

In the Battelle Computer Center's rate structure, each resource is priced separately. The user can choose those resources which solve his problems at least cost. He can, for example, choose between sequential tape files and random or index-sequential disk files. At varying costs, his data can be stored on-line, or in on-site or off-site storage areas. His applications can operate in a batch or interactive environment, or both. He can produce printed, graphical, or microfilm output. He can use a particular resource once a year or many times a day. In addition, he does not have to be concerned with justifying the acquisition of new hardware to meet the need of "that new" applications program.

In today's unbundled environment, software packages can cost money too. One of the policies of the Computer Center is that all software developed or acquired by the Center is made available to all users. Because of this, the colleges have a wide choice of computer languages and application

packages available to them. Frequently software products are needed at a college for one course or part of a course, but the software license may require a minimum lease period. Individual justification would be difficult; however, with many colleges plus Battelle's internal needs, such packages are often easily justified.

How do the costs of participating in the program compare to having a typical small in-house computer? Assuming that a college has had little or no previous data processing experience and looking at a five-year comparison, the total costs over the first four years are roughly equivalent for the "average" college. If there is a cost advantage, it would appear to be in favor of the program. If the college is one that progresses more rapidly than the average, there is a distinct advantage to the program, whereas, if the college progresses more slowly then the advantage will shift depending upon whether progress was comparatively slower during the "first" or "second" year.

The big advantage of the program occurs after the fourth year. By this time the college has outgrown the small computer and finds that the next step upward in hardware is quite expensive. In addition to the increase in monthly rental, there will be conversion costs if the language of the small computer is not supported on its replacement. However, the most distressing aspect is likely to be that there is no one practical choice of a computer that will provide the needed additional capability for both administrative and academic users. The needs of one or the other must be sacrificed or two new computers will be required. None of this happens under the program, of course--costs simply continue to increase modestly as usage grows.

There are other cost factors which favor the program. Battelle and the colleges have jointly purchased supplies, thus reducing these costs. In-house software support, of course, is less; for example, the colleges do not need to hire systems programmers or contract with the manufacturer for software support. Also, the broad base of experience existing at the colleges and Battelle can frequently result in immediate answers to questions that would otherwise require experimentation and create delays.

What about cost control? When talking to prospective new members, one of the most frequent fears we hear is that they will be unable to control their costs. There is a general feeling that with an in-house computer, monthly costs are fixed. And, perhaps they are--until one needs to upgrade! Neither students, faculty, nor administrative personnel will be long satisfied with the argument "that the computer is loaded". When pressures mount, a large incremental cost instead of a gradual increase in cost then becomes the problem.

It is possible to exercise control and the colleges do do it. In each college the data processing center acts as a cost center. They pass both Battelle's costs and their own center's costs along to the end user. Battelle costs are available to them on a daily basis. Each day--as they start operations--the month-to-date costs on each account, plus individual

job accounting, are available to them through the computer on an on-line file. On some regular basis, generally weekly, they process this data by running their own accounting program. Thus, the end user, as well as the Data Processing Director, can be constantly aware of his costs.

As indicated at the beginning of this section, job-by-job accounting and costing can be a very effective tool for cost control. Nevertheless, it is often resisted. Frequently, we hear the comment that "it will destroy the experimentation needed in the educational process". A similar claim is often made with respect to research. However, both research and the experimentation that goes with it have flourished at Battelle. The computer, after all, is a tool--and a relatively expensive one. Too much experimentation by a few can deny the use of that tool to others. The only effective control is cost--or perhaps we should say "cost visibility". Making the cost of each user (and of each use of the computer) visible is a useful function, regardless of who actually pays for or supports that cost. In general, if experimentation is well planned with reasonable objectives, it can be justified. In any case, simply ignoring that a cost is attached to experimentation--even with an in-house computer--serves few desirable ends.

ADVANTAGES OF THE PROGRAM

At this point, we will summarize the main advantages of participation in BECUN while also indicating many of the results which have been generated. Some of these advantages would be enjoyed in any effective program of facility sharing. Others are unique to this particular program and stem partly from the need to satisfy Battelle's own research needs. The reader will be able to distinguish between the two. No particular significance should be attached to the order in which the advantages are listed.

(1) Cooperation Among the Participants--In the long run, we believe this will be one of the major benefits of the program. To insure regular contact, representatives from each college meet with Battelle personnel once a month. At these meetings, discussion occurs between the colleges and Battelle and among the colleges themselves. A wide variety of experiences, needs, and desires are discussed, and the rate of growth of each individual college is greatly enhanced by these exchanges. Often special presentations are planned as part of each meeting. Recent topics have included: Computer Science program at other small universities, structured programming, common administrative systems, and microprocessors. Cooperation has occurred in many other ways. Representatives from schools often visit each other to discuss specific application areas. The schools have also worked together in joint projects. A major example of this was the development of

slide/cassette courses in the BASIC and COBOL programming languages. Under the primary direction of two professors from Otterbein College, the courses were developed with both financial support and technical review from all of the schools and Battelle.

(2) Hardware and Software Capabilities on a Par With the Largest Universities--This benefit is, for a group of this size, unique to the program. By the very nature of Battelle's research needs, the Computer Center must have large-scale computing capability current with the state of the art. The colleges reap the benefits. The monthly rental cost of the hardware in the Computer Center has more than tripled since the start of the program. We have heard it argued that the colleges do not need all of these capabilities. We agree that they do not need them all of the time. Nevertheless, each of the three older participants have, at one time or another, made good use of practically every capability available. And since the participants pay for a capability only when they use it, the mere availability of an "unnecessary" capability costs the colleges nothing.

(3) Costs Increase Gradually Rather than in Large Increments--The benefits in this respect are obvious to anyone who has attempted to justify additional hardware or software. It is true that even though the cost of computer usage increases gradually, the colleges can be faced with some modest incremental increases. These occur when a remote batch terminal is installed, or when additional communications capabilities are added. While they may be as difficult to justify as any other increase in hardware costs, they do, fortunately, occur infrequently and are normally small in magnitude.

(4) The Colleges Receive a Service--As a group, the colleges represent one of the Computer Center's largest users. As such, they are in a position to request and support the services required to fulfill their needs. For example, the operational hours of the Computer Center have been changed at the colleges' request. (Saturday hours were expanded and Sunday hours were added.) Joint software development efforts sponsored by the group were mentioned in an earlier section and, although we have yet to acquire any major hardware specifically for the colleges, we have made software acquisitions for this purpose. In general, we feel that the colleges are availed of services for educational purposes far in access of those of all but a few in-house university computer centers.

(5) Students Learn to Use the Computer as a Tool--With the available hardware and software, students can turn their attention to problem-solving as opposed to spending time "shoe-horning" a large application into a small machine. In addition, students learn how to communicate with the computer via a modern operating system as opposed to hands-on operation. This is an important point since most installations do not permit programmers hands-on utilization of the computer. In fact, in many installations the programmers seldom see the computer so that students trained in a hands-on environment must often be retrained at a cost to the employer. Students graduating from participation in BECUN learn to use data processing under conditions generally found in the outside world.

(6) Applications Are Economically Justified at Their Inception--This point was discussed in detail earlier. The main advantage is that costs for each and every application stay "visible" and so are subject to control.

(7) Staff Support--As discussed earlier, the Battelle staff has assisted the colleges in many respects. To date, almost all of this support has come from the Computer Center staff; however, future support could well involve other areas of expertise.

(8) Cost--This point was discussed in detail earlier. Both short-term and long-term savings can accrue to the participants.

PROBLEM AREAS

As can be expected with any major program applying new concepts and covering a variety of participants, problems have occurred. The following problems have been encountered at one stage or another and the appropriate actions taken.

(1) Communications--The distance between the central site (Battelle) and the remote sites (colleges) has made it more difficult to communicate appropriate information. It can be very frustrating to be at the end of a communications link wondering if the computer is down or if your job has been run. To overcome this, several actions have been taken. First, the monthly meeting between all participants insures an open forum for appropriate discussions. Second, documentation such as the User Bulletin is sent periodically to each school. Third, the schools often make trips to Battelle to discuss specific needs. Finally, efforts have been initiated to visit each school on a periodic basis as a form of circuit

riding. These trips have often included Battelle staff from both Software Support Services and Operations so that they may meet the people from the "other end of the telephone line" and relate better to their needs.

(2) Uncontrolled Usage--Since the computer's capacity is relatively "open-ended", its usage can be abused if completely ignored. It is sometimes tempting to let the computer do all of the work. Control of usage has been primarily implemented through complete and up-to-date reporting of all machine usage. A college's Data Processing Director can easily identify and review his usage including job-by-job accounting. In addition, special software has been implemented to permit limits to be established for the generation of on-line files.

(3) Own Equipment Syndrome--Since many people come from backgrounds of "hands-on" experience with their own equipment, they often hesitate at the thought of losing control of the resources. If they can be convinced to try connecting to a central site, experience has shown that they soon will overcome this feeling. Many of the current schools have indicated that they prefer not worrying about putting up a new operating system or having maintenance done on the central processor and can better devote their time to more important problems.

(4) Academic/Administrative Imbalance--During the first few years of operating a remote batch terminal, growth is normally more rapid in administrative computing. Thus, both input/output volumes and costs soon exceed those of academic computing At this point it is important that the faculty/student needs are not overshadowed. Full cooperation is necessary in areas of scheduling, budgeting, etc. The colleges have handled this most successfully under the direction of the Data Processing Directors who must keep the needs of both in mind.

FUTURE PLANS

Many new areas for applying computers are continually being explored at each of the schools. In addition, new capabilities/techniques are being implemented. Otterbein has obtained an intelligent, interactive terminal which is used off-line for data entry/edit in many administrative areas. The terminal is then used to transmit the data to the central site for further processing.

Wooster has obtained an interactive graphics terminal for use by faculty and students. The low-cost, direct-view storage tube terminal provides them with the capability to generate graphical results from statistical analysis, etc.

An effort is currently underway to "package" selected administrative systems. The Alumni Records System has been chosen as a pilot for this concept, whereby Battelle will provide continuing support for this software. The improved, packaged systems will then become available to both existing and new schools.

SUMMARY

There are a number of other aspects of the program which deserve mention. One is that the availability of a large computer has been an important factor in faculty recruitment. For instance, one of the colleges was able to recruit an excellent young faculty member from a large university partly because they could provide him good turn-around on a large computer. The computer facility is also important in the recruitment of students, many of whom recognize the vast future importance of computer technology.

Faculty research is greatly enhanced. Members of the Wooster faculty have studied the life of Jesus by using the computer to analyze the words and phrases He used. Antioch faculty had developed simulations, particularly in the area of ecology. These progr[illegible] and many others, would not have been possible without a computer--and wou[illegible]have been difficult, at best, on a small computer.

Both simple and sophisticated administrative systems have been developed depending upon each school's needs. Written in COBOL, these are user-oriented systems that are designed for easy maintenance and modification. Administrative users do not have to memorize a lot of numeric codes "because the computer has trouble handling anything but numbers". Sizes of records and sizes of fields are not limited. The computer can determine "who are John's parents", or "does Bill Jones' employer have a matching gift policy", or "who might donate to the new theatre". Class lists are available prior to the first class. Academically deficient students are identified very early and are counseled. And most important of all, the computer does not make administrative reports "late".

Battelle is proud of BECUN, and we believe that the colleges are also. The members are maturing rapidly in data processing. On the administrative side, they know more about themselves than ever before and, academically, they are teaching the use of the computer as a tool--as opposed to teaching programming. Faculty members are gaining increased recognition based upon research they have conducted with the aid of the computer. The program we believe is a great success and an excellent example of what cooperation among privately supported organizations can do.